> girls to call out answers ([Sadker et al 1985] in [Van Nostrand 1990, page 187]).

(See also Section 1.2.1.) By taking classes at women's colleges or in women's studies, which almost always have a large majority of women, female students feel free to more actively participate in the classroom and are taken more seriously by teachers and other students. While advising technical females to consider single-sex high schools and colleges may appear counter-intuitive, particularly because these schools often have less adequate laboratory facilities, studies have shown that females at single-sex schools study more science and mathematics than those in coeducational schools [Kelly 1982, page 499], are more likely to continue in science [Ferry et al 1982, page 27], and are disproportionately successful compared to other women [Gilbert et al 1983].

Another advantage of women's studies programs is their emphasis on women's achievements. One female computer science student had the following experience:

> When I entered my first women's studies class, on literature written by women, I expected to encounter second-rate works that were only being taught when the ground rules eliminated male competition. Instead, the books were first-rate, and I wondered why I had never read them before. The class taught me that women's achievements had often been overlooked. (I had been pretty misogynic before that.)

Because of men's numerical and figurative dominance in engineering classes, a student in a women's studies course can find herself listening to vocal female students for almost the first time since entering college.

Another benefit of women's studies programs is that they document the barriers women have faced. It is important for women to realize that the paucity of women in the field does not imply that women are inherently unable and that negative behavior they encounter may be due to their sex and not to any actual shortcomings on their parts.

Female Role Models

Finding female role models and mentors can also be helpful to a woman's self-image. While male mentors are certainly useful, and many women are happy with male advisors, female role models serve the additional purpose of providing a living example of a successful female scientist. One study found that "[f]emale graduate students who identified female professors as role models viewed themselves as more career oriented, confident, and instrumental than did female students identifying male role models" [Gilbert et al 1983, page 597], although, as the report notes, self-selection may also have been a factor [Gilbert et al 1983, page 605]. As noted in [Leveson 1989, page 20]:

> The importance of mentoring and role models cannot be stressed too much. One female student ... wrote about her experience in a summer job working for a female manager who she described as: 'one of the most respected people in the company. I had never expected that having a female role model would change the way I felt about myself, but it did'.

Thus, a female student should consider finding a senior woman in her field to work for at school or during a summer job. While a person's sex should not be the primary factor in choosing a mentor, spending some time with a female role model can be psychologically beneficial. (See also [Simeone 1987, pages 104–109].)

Women's Groups

In part because female computer science students so outnumber female professors, one-to-one contact is not always possible. Many schools have get-togethers for women in computer science or engineering, ranging from informal annual meetings to regular meetings of the Society of Women Engineers. Women find these activities useful for receiving encouragement and advice, and they "generate a lot of good feeling" [Leveson 1989, page 23].

Perhaps the most effective group currently existing for women in computer science is an electronic mail discussion group with over seven hundred members which provides women with a "forum for discussion of both the problems and joys of women in our field and a medium for networking and mentoring" [Frenkel 1990, page 36]. Women share advice on female-specific topics such as the best time in one's career to have children, how to dress for conferences, and how to deal with sexism, as well as general-purpose networking. The list is particularly important to women in computer science because they are so dispersed and might not otherwise be able to interact with many other female computer scientists and engineers. Being part of a discussion group with hundreds of female computer scientists can change a woman's default image of a computer scientist from male to female (or neutral) — quite a difference from a student's academic experience, where two thirds of the computer science departments have zero or one female professors [Gries et al 1991].

5.1.3 Ways for Women to React to Biased Behavior

In cases of blatant sexual harassment, a woman can usually complain to some authority. In less clear-cut but nevertheless offensive situations, this option is often not open. While acting as a group and writing a report was effective for women at MIT [MIT 1983] and Carnegie-Mellon [CMU 1989], often women must react individually to behavior they find unacceptable.

Reacting to Subtle Discrimination

As discussed in Section 1.2.1, women are often the victims of subtle subconscious bias. For example, a woman may find that comments are primarily directed to men in a group, unintentionally leaving her out. If the woman does not feel comfortable directly confronting the individuals in question, there are more diplomatic methods of calling the behavior to the person's attention:

- In a meeting of three computer science students, the sole female found herself ignored by one of the male participants. Whenever she asked him a question, he directed his answer to the other male present. (See page 12 of this report.) After the meeting, the woman took him aside and mentioned that she had noticed he had directed his answers to [John] and asked, in a concerned way, whether she had done anything to cause this behavior. When he replied that she had not done anything wrong and began to apologize, she dismissed his apologies by saying that she was just relieved she had not given him any negative signals. He continued to apologize.

  The indirectness of her approach allowed the man to save face while still communicating the point. It appears to have been effective, because, when she saw the man later in the day, he made eye contact and spoke directly to her.

- At a social occasion, a young woman found that a male relative directed serious discourse almost exclusively to her brother and not to her. When the woman was alone with the relative, she said to him, 'I hope I haven't given you the idea I'm not interested in your opinions on [X]. I noticed you directed your comments about it to [John]. I want you to know I am interested in what you have to say on the subject.' The male relative replied, sincerely, that he had not realized she was interested in the topic and would include her in the future.

While some people might object to these oblique methods, as they involve the victim's pretending to put the blame on herself, they are effective in situations where the woman does not feel comfortable being more direct, and they often elicit an apology.

Reacting to Overtly Sexist Comments

Indirect methods are also often more effective than direct means for dealing with offensive sexist and sexual comments. As mentioned in Section 2.2.2, the only consequence of complaining is often that one is dismissed as a 'feminist'. In a recent column in *The New York Times*, a woman described her experience as a college journalist:

> Though I was militantly middle of the road in perspective, by the second time I mentioned sexism in print I was pegged. People I met seemed to treat me like a Marxist, a radical, a testosterone-fueled male-basher; others asked me why I suddenly hated men so much; and certain folks at home warned me that I was going to jeopardize my future by scaring off potential male suitors [Kamen 1990].

Two techniques that are often more effective than anger (even when justified) are role reversal, which involves the substitution of other terms for female terms, and humor. Combinations of these two techniques are especially effective.

Role Reversal Treating men in the manner in which they treat women can be an effective response to poor treatment:

- One female computer scientist said:

  > I'm much more often complimented for my dress, my hair, or my accent than for the content of what I say and do. So I just turn the compliments around and tell men how pretty their ties are, or how the cut of their jackets bring out their broad shoulders. They squirm under such scrutiny just as we do [Frenkel 1990, page 41].

- When a group of men were unable to understand why women in the workplace were offended by posters of naked women, a woman put up a huge picture of a naked man. She was asked to take it down, communicating her point.[3]

Substituting terms pertaining to race instead of sex can also be effective:

- Someone who does not understand why it is offensive to call a grown woman "girl" should be asked whether they would call an adult black male "boy", something that also used to be considered acceptable.

- A female computer scientist related the following story:

  > [A few years ago,] I wrote to Time Magazine to register my opinion about a 'humor' piece titled 'Women Are Getting Out of Hand', which included lines like 'Women are getting too big for their britches'. I suggested that they would not be likely to publish articles like 'Blacks Are Getting Out of Hand' or sentences like 'Hispanics are getting too big for their britches'.

See also the passages in Section 3.3.3, which, while impractical for conversation, also make the point.

[3] Actually, the reason she was asked to take it down was because a nearby man was afraid he would be suspected of being homosexual.

Humor Humor is effective for several reasons. First, when men make offensive remarks, if someone protests, they retort: "Can't you take a joke?" When a woman uses humor to protest an offensive remark, she can offer the same response if challenged. Additionally, humor breaks tension and often allows one to point out that something is wrong without a direct confrontation.

One female computer professional told the following stories:

- Shortly after my appointment, my boss, V.P. of Administration, called a meeting to discuss the problems of the center. All of the attendees were male and deans or equivalent high positions. The discussion in that meeting was quite heated with adamant remarks about the problems in computing on campus. Towards the end of the meeting, one of the attendees started pounding on the table and reviewed the names of the previous male directors of the center, ending with the comment, 'No offense meant, [Jane], but we need a man in this job.' I responded with, 'I'm willing to do almost anything to fix the problems in the Computer Center, but a sex change operation is out of the question.'

  That turned out to be the perfect response — I got my point across and it broke the tension with laughter. The moral of this story is, that if you can make your point with humor, the message goes down easier.

- Another time, I received in the mail an advertisement from a company that sells disk drives. The advertisement was included in a box that contained Havana cigars. (Obviously, this company assumed that the mailing list they had of CIO's were all men). I wrote a letter to the VP of marketing for the company telling him that I thought that one of his competitors were trying to undermine the intelligence of his marketing organization by sending cigars to female decision makers in his company's name. Two days later, I received a federal express delivery from him — it was a bottle of perfume with a letter of apology. I thought his response was a good recovery.

A computer science professor told the following story:

> [W]hen I first starting teaching 13 years ago, I was married at the time and both my husband and I had teaching positions in the same department. My department head was sitting in my class (at the time we were in a joint math and CS department and my department head was retraining). [O]ne day, one of my students referred to me as Mrs. [Smith] in class and I was feeling pretty frustrated by that point since I had noticed that I kept getting called 'Mrs.' while my husband was [called] 'Dr.', so I looked at him and said 'What do you call Karl?,' and he replied 'Dr. [Smith]'. So I told him that I'd appreciate it if he would use the same title for me since I had the same degree. Well, he wasn't the type to quiet down quickly, so he

retorted, 'And what does Karl think of your feeling that way?,' to which I replied angrily, 'It doesn't matter what he thinks; it was a helluva lot harder to get a Ph.D. than it was to get married.' Word apparently got out to the students after that because I wasn't called 'Mrs.' for quite some time. (Of course, I was shaking by the time class ended wondering what my department head thought of that reaction. He never did say anything about it.)

Female computer scientists have combined the techniques, role reversal and humor, as in the following incidents:

- A female computer scientist reported:

> A few years ago I was at a workshop held way out in the country.... There were about forty people there. I don't remember how many were women, but there couldn't have been many.
>
> At one point we were sitting around singing, and after a while someone started one of those make-up-a-verse of your own affairs.... It went around for a while, and someone offered,
>
> I know a girl, her name is Jill.
> dum-de-dum de dum-dum-dum-dum
> She won't do it, but her sister will.
> dum-de-dum de dum-dum-dum-dum
>
> Well, I can't carry a tune in a bucket, but I co-opted the next verse:
>
> I know a guy, his name is Bill.
> dum-de-dum de dum-dum-dum-dum
> He won't do it, but his brother will.
> dum-de-dum de dum-dum-dum-dum
>
> Everyone laughed, and I thought the matter was settled. But some people won't give up, and a few rounds later, the *same* fellow came around with:
>
> I know a girl, her name is Sue.
> dum-de-dum de dum-dum-dum-dum
> She won't do it for me, but she'll do it for you.
> dum-de-dum de dum-dum-dum-dum
>
> Drat! Can't back down now ... I got as far as:
>
> I know a guy, his name is Lou....
>
> when the *rest* of my colleagues shouted down the offender.

- A female computer science graduate student reported the following incident:

> A [campus] career recruitment poster, several years ago ... made quite a splash. The poster portrayed two men in shirts and ties picking up a printout off a line printer, dropping the fanfold paper all over the floor as they ogled at a woman walking by in a miniskirt. The caption: 'We think about more than just work here at [Company Name].' Outraged women began tearing the posters off the walls, then (insert light bulb here) they instead made photocopies and put them up in great numbers all over campus. Meanwhile, the recruiters figured out something was wrong and tried desperately to get rid of them. A number of women went to the recruitment talk to disrupt it, and found that they were the only ones there. Several hack posters were created, for example one with two women in businesslike garb poring over a printout while a scantily clad beach-boy type walked by, with the caption, 'We think about more than just sex here at [Company Name].' I believe the president of the company issued a formal apology afterward. This one is notable as much for the reaction of the student body as for the poster itself.

5.1.4 Ways for Individuals to Encourage Women

Most of the suggestions in this section involve avoiding behavior that was described elsewhere in the report as potentially offensive. Because the reader is assumed to have read the rest of the report, a minimum of justification appears in this section.

Fighting Subconscious Bias

As described in Section 1.2.1, many people treat men and women differently without realizing it. Once people understand that it is possible for a well-meaning person to unintentionally discriminate, they should train themselves to oversee or spot check their behavior to make sure they do not behave in such a manner. Anecdotal evidence suggests that, once people become aware of subconscious bias, they often catch themselves behaving in such a way. This is true of women as well as of men. Fortunately, once a person is aware of the problem, the behavior is usually easy to change. Examples of behaviors to avoid are:

- Assuming, without any information, that women should be given easier questions or projects than men.
- Paying more attention to remarks made by men than by women.
- Assuming, when introduced to a team, that a male is the leader and primarily addressing comments to him.

- If a man, being more friendly and encouraging to male peers and subordinates than to females, even if it is out of a desire to avoid having one's friendliness mistaken for flirtation.

- Assuming that a woman will not pursue her career as seriously as a man because she will leave her job to have children. While some women take time off for children, all women (and no men) are hurt by this prejudice.

Additionally, one can help counteract another person's subconscious bias by either discreetly calling it to the person's attention or by directly offsetting it. For example, if a female colleague keeps getting interrupted or ignored, one can express interest in what she is saying without directly telling people to listen to her, which might be interpreted as patronizing.

A female graduate student provided me with some positive examples of how her advisor treated her. In addition to generally treating her with respect, by giving her challenging projects and the necessary resources to complete them, there were two specific things he did that especially impressed her:

- When the student was preparing a paper the two of them co-authored for a conference, she made a dozen copies to send in, as required by the program committee. When her advisor saw her collating them, he told her that she should have had the group secretary do that. The student was impressed with this remark because she felt other professors might see nothing wrong with a female's doing clerical work but would have only redirected male students to a secretary.

- When the student proofread a paper for her advisor, he thanked her by name in the acknowledgments "for her careful proofreading of this paper and [acknowledged] her ongoing study of [related research area]". By mentioning her research area, the advisor made clear to readers that, despite her female name, she was not a secretary.

Avoiding Unintentionally Offensive or Discriminatory Behavior

While any well-intentioned person avoids behavior that they know to be offensive, some people do not realize that certain behaviors, discussed throughout this report, offend some women. Good intentions are no guarantee that women will not get the wrong message. For example, a woman might feel uncomfortable with a man who has revealing pictures of women on his walls or computer screen. Additionally, by not using language that could be interpreted as sexist, such as "he" for the generic computer architect and terms like "manpower", women feel more included. One positive example is the name on a sample application for the United States Department of Defense fellowships, included in the instruction booklet: "Smith, Dana Robin." Both "Dana" and "Robin" can be either female or male names. Another positive example is the alternating usage of "he" and "she" as the default singular program in chapters of the influential *Computer Architecture: A Quantitative Approach*, by John Hennessy and David Patterson. There are many guides to "nonsexist" communication, such as [Persing 1978].

Someone who supervises a research or work group or organizes its events should try to choose activities at which all group members would feel comfortable. While it is not always possible to choose an activity that everyone relates to — for example, some people are uninterested in any sport — an effort should be made to include everyone in at least some of the social occasions. I have seen people repeatedly left out of social activities springing from the workplace because they are poor athletes or disabled, have unusual dietary requirements, or do not drink alcohol. Anyone who cannot socialize with the group will not feel as though they fully belong. (Conversely, anybody who does not want to socialize with the work group, for whatever reasons, should not be made to feel unwelcome as a worker.)

Encouragement

Some professors rarely encourage or praise their students, but such encouragement, even if just a few spoken words, is greatly appreciated and rarely forgotten [Widnall 1988, page 1743]. For example, suggesting that a student consider graduate school can make a substantial difference [Leveson 1989, page 23]. In one survey of female scientists, "[t]he encouragement of teachers — along with that of fathers — was the influence most frequently quoted as steering [them] towards science" [Ferry et al 1982, page 27]. In practice, women often do not get encouragement from teachers and guidance counselors ([Cooper Union 1989] in [Baum 1990, page 48]). While encouragement should be directed to worthy males and females, it has greatest effect with people who receive little encouragement and who have low self-esteem, often women [Zappert et al 1984, page 8]. (See, for example, page 10 of this report.)

Additionally, it is important for parents to encourage their daughters as well as their sons in technical areas. "According to one computer camp director, 'Mothers bring their boys to the classes. Girls have to beg to enroll'" [Hess et al 1985, page 201]. Even if parents do treat their children equally, it is impossible to make girls feel that it's as normal for girls to use computers as it is for boys, with all the biases in our society (Section 1.1.3) and in children's toys and computer games (Section 1.1.2). Nevertheless, it is clearly important to encourage one's daughters, and many female computer scientists attribute their career choice and success to parents who encouraged them.

5.1.5 Discussion

Readers will notice that there are many situations for which I made no recommendations. For example, I had no advice for the woman who told me about dining with a group of men after a conference who then began telling jokes that were specifically degrading of women. I also have found myself with nothing to say when a brilliant female graduate student says she avoids a certain research area because of the specific men at the university involved in it. Unfortunately, there is a substantial class of behavior which is both offensive and non-actionable.

5.2 Conclusions

A common thread through the previous chapters is that, for the most part, people are not consciously trying to discourage women from science and engineering. Instead, people's behavior is often subconsciously influenced by stereotypes that they may not even realize they have. Additionally, when companies direct technical games and products to men, their intent is not to perpetuate stereotypes but to target the largest existing audience. That some women feel uncomfortable in mostly male environments is not primarily a result of men's trying to make them feel unwelcome but of dynamics resulting directly from the male majority and societal sex-based differences in behavior. While perhaps it is comforting to know that no conspiracy exists against female computer scientists, it also means that the problem is harder to fight. The negative influences described in this report are so varied and decentralized that there is no simple way to level the playing field.

One positive factor is that women and other underrepresented groups are becoming a crucial resource pool. The number of white males of college age is decreasing, while the need for engineers and scientists is increasing [Leveson 1989, page 7]. I have been told this is causing even the most conservative businessmen to begin aggressively targeting women and minorities as highly-trained technical workers.

Another reason for optimism is seeing how greatly the situation has changed. Although discrimination against women continues, it is nothing compared to the level earlier this century or in the previous one, as some of the quotations at the beginning of chapters have indicated. Unfortunately, there has been retrograde motion before: In the 1920s, feminist activity reduced sexual discrimination at prestigious universities, but "this trend toward equity was reversed in the 1930s and not resumed until the 1960s" [Simeone 1987, page xi].

Appendix A

About This Paper

A.1 Data Collection Methods

In this document, I include some anecdotal evidence in addition to quoting other studies and reports. One way I solicited information was through computer networks. I posted requests for information to private and public electronic mailing lists — that is, systems that allow a person to send messages from their computer to the computers of other people. My initial request is included in Figure A.1. It was sent to a private list of women in computer science and the following public "newsgroups" (electronic bulletin boards): comp.society, comp.misc, alt.folklore.computers, comp.edu, soc.women, and soc.feminism. From the net, I got roughly 150 responses. Some of these included pointers to published reports or to examples of sexism or anti-sexism in published works. These letters often included reactions (such as "I found such-and-such upsetting") and opinions ("I am opposed to such-and-such"). Other letters included anecdotes. Some of these letters were from sources I had reason to trust (friends of friends); for others, I had no way of verifying any stories. Other categories of letters were polite dissent and "flames" — attacks from people who disagreed with whatever they inferred from my call for information. As described in the introduction, I also learned from my critics and attackers.

The data in my paper falls into the following categories:

1. Published statistics.

2. Quotations from computer books or magazines.

3. Events I have personally witnessed or taken part in.

4. Quotations and paraphrases from published and unpublished reports.

5. Anecdotes and opinions from people I know.

```
For one of my classes ("Women and Computers"), I'm doing a
project on ways in which the message
"Computers/Science/Engineering isn't for girls/women" (or
the opposite) is communicated.  Some examples would include:

- Computer ads featuring scantily-clad women.

- An ad I received for a pink calculator that could
  fit in my "chic little handbag", with large keys
  to keep from breaking one's "gorgeous nails."
  (Their words, not mine.)

- Being treated differently by teachers or coworkers.

I've been collecting some of the more egregious examples for
the past few years, and I'm hoping some of you have your
favorite examples.  I am interested in xeroxes or references
to items in print as well as anecdotes.  Despite the
one-sidedness of my examples, I am interested in both pro-
and anti- female material.  Please email me
(erspert@athena.mit.edu) or physically send material to:

Ellen Spertus
MIT AI Lab, room 630
545 Technology Square
Cambridge, MA 02139

I will send copies of my report to anyone who contributes
and/or is interested.  Thanks in advance for any help.
```

Figure A.1: Call for Data

6. Anecdotes and opinions from friends of friends.

7. Anecdotes and opinions from people I don't know.

Readers will have their own opinions on how much credence to give to each category. The only category I have qualms about is anecdotes from people I do not know. Consequently, I have never based an argument entirely on them. Unfortunately, anonymity was important to many people who gave stories, and I decided all contributions, except from published or privately-distributed reports, would be anonymous and contain as little identifying information as possible. In my records, I have the source of every piece of data or story, in context. If any reader, for their own studies or peace of mind, needs to know the trustworthiness coefficient of a given anecdote, they can contact me, and I will provide whatever further information I can without violating anonymity. While false anecdotes could have been passed on by dishonest or misinformed sources, it is highly unlikely that more than one or two, if any, exist. In any case, I have prefaced unvouched-for opinions and anecdotes to indicate the level of indirection, i.e. "a female graduate student wrote such-and-such" instead of "a female graduate student had the following experience".

A.2 The History of the Document

This paper was begun during the spring of my senior year, as a term paper for a course entitled "Women and Computers", taught by Prof. Sherry Turkle. Because the paper was so long and because I had other graduation requirements, I did not finish it until the following January, when I presented the paper during MIT's Independent Activity Period. I also distributed the paper through electronic means, mostly to female computer scientists, some of whom further distributed copies. Because of the interest the paper generated and the support of the department, I decided to turn it into an Artificial Intelligence Laboratory technical report, the simplest way to semi-publish a document.

I had expected negative reactions to my report, on the net and at MIT, but I was pleasantly surprised. Only a few netters sent negative email, and nobody at MIT gave me any trouble. In fact, the head of the EECS department, Prof. Paul Penfield, was supportive of the project, providing xerox money, and read the report. The associate head for CS, Prof. Fernando Corbató, attended my talk. A number of computer science professors, male and female, also read the report and expressed encouragement.

I made many changes between the original and this version of the report. In addition to correcting typos, changes were:

- Correcting misleading statistics.
- Incorporating anecdotes and reactions sent in response to the original report.

- Including material from additional articles and books.
- Reworking the section on affirmative action to correct my prior misconceptions.
- Removing an email conversation with a "flamer" that had been included as an appendix.
- Adding an appendix on advantages women have.
- Adding quotations to the beginning of the chapters.

The differences between the two versions are large enough that I would now prefer people to treat the original as a draft and not duplicate or quote it.

A.3 MIT

"Barriers to Equality in Academia: Women in Computer Science at MIT" [MIT 1983], published in 1983 and describing some of the problems faced by women at MIT was distributed widely. Unfortunately, some people incorrectly inferred that MIT was a worse place for female computer scientists than other schools. There is no reason, however, to think that it was any worse than other CS departments. In fact, it was probably better, since there were enough women at MIT to write such a report and the administration was supportive enough to encourage it. I want to take this opportunity to defend MIT's reputation.

Specifically, MIT's CS department is more supportive of women than other schools' in the following ways:

- There is support for reports such as "Barriers to Equality" and this one.
- The sensitivity of the department has been increased by these reports. This may be the reason I do not see pictures here of nude women on walls or computer screens, still common in other places.
- There is an unusually strict policy against romance between faculty and students. Professors are not even permitted to date students in other departments.
- There are no sexist or harassing professors that female graduate students warn each other about.
- There are four female professors, three of them tenured, all of whom have expressed support of female students in one way or another. As of 1989, only 9 departments nationwide (5.6%) have this many women [Gries et al 1991].